

Determining cloud-level winds in the Venus atmosphere with telescopic infrared images of the Venus night side and a team of citizen scientists

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Abstract

The Venus Winds project at the Denver Museum of Nature & Science seeks to determine wind speeds in the Venus atmosphere by analyzing infrared images taken by the NASA Infrared Telescope Facility (IRTF). The atmosphere of Venus rotates up to 60 times faster than its solid body. The mechanism that drives this atmospheric 'superrotation' is not well understood, primarily for lack of observational data. A corps of citizen scientists is processing and analyzing more than 80,000 images of Venus taken since 2001. These images are of the night side of Venus, where heat from the deep atmosphere is observed at a wavelength of 2.3 μ m. The patchy lower clouds of Venus appear as silhouettes, blocking the outgoing radiation where the clouds are thickest. Images are assembled into movies of the motion of Venus' lower cloud deck. The movies are then used along with geometric information to calculate wind speeds and direction across the planet. Variability in the wind field, such as the appearance and disappearance of jet streams, eddies, and waves, holds clues to the origin of Venus' atmospheric superrotation. The project uses a set of wiki pages to store the raw telescopic data, processed images at every step, instructions and methods, each collaborator's calculations, and movies generated by each of the participants. The Venus Winds project wiki pages can be found at http://wiki.boulder.swri.edu/mediawiki/index.php/Venus_Winds_Wiki The project is partly supported by a grant from the National Science Foundation.

Outcomes

This collaboration of professional and amateur astronomers has yielded cloud-level winds in the Venus atmosphere from approximately -70 to +70° latitude for the mornings of July 12 and 13, 2004. Cloud features that were seen on the morning of July 12, 2004 can be also be seen in the July 13 images, having rotated about 65 degrees towards the terminator. Such consistency of features on Venus from one night to the next is very rare, and has permitted, for the first time, the determination of average wind speeds over a 24 hour time base.